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BELL, BRUCE F	
ART UNIT	**PAPER NUMBER**
1795	

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05/22/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/525,242	LORENTSEN ET AL.
	Examiner	Art Unit
	Bruce F. Bell	1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *63-94* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *63-94* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *22 February 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 82, 92 and 94 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claim 82 sets forth oxide based cermets, metals, metal alloys, oxide ceramics and combinations or composites thereof, however, the instant specification only provides support for ceramic materials and cermets. Cermets do not have to be oxide based and ceramics do not have to be oxides, they can be carbides, for instance. Therefore, there is not adequate support in the instant specification to narrow the scope of the instant claims for oxide based cermets and oxide based ceramics, only.

Claim 92 sets forth that the at least one anode and at least one cathode are connected to a periphery busbar system for electrical supply of cells arranged end to end or side by side. The examiner can not find anywhere in applicants instant specification setting forth that the anode and cathode are connected to a periphery busbar system for electrical supply of cells arranged end to end or side by side. Therefore, there is not adequate support in the instant specification for this aspect of the instant invention as set forth in the instant claim.

Claim 94 sets forth the electrolyte being a mixture of at least one of a metal fluoride of group 1 and 2 elements in the periodic table according to the IUPAC system. The instant specification only sets forth that the electrolyte can be of an alkali or alkali earth halide but never sets forth that it be a fluoride, so therefore, it could be a chloride or bromide or iodide, rather than a fluoride, therefore, there is not adequate support in the instant specification to narrow the scope of the instant claim to just a fluoride. Further, this claim sets forth that the electrolyte can be a component based on the alkali or alkaline earth halides having a fluoride/halide molar ratio as set forth in this instant claim, however, no support for this embodiment is set forth in the instant specification as submitted. Therefore, there is not adequate support for this aspect of the instant invention.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 82 and 94 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 82 is vague and indefinite with respect to oxide based cermets, metals, metal alloys, oxide ceramics and combinations or composites thereof, since the instant specification only provides support for ceramic materials and cermets. Cermets do not have to be oxide based and ceramics do not have to be oxides, as they can be carbides, for instance.

Claim 94 is vague and indefinite with respect to what the electrolyte mixture may or may not include since the components as set forth with respect to the fluoride/halide are not clear with respect to the molar ratio, and content of the halides and fluorides that may be used.

5. The disclosure is objected to because of the following informalities:

Page 6, line 16, please insert, “Summary of the Invention”.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 63-94 are rejected under 35 U.S.C. 103(a) as being unpatentable over de Nora (6540887) in combination with de Nora (6093304), deNora (6656340) and Julsrud et al (2004/0178079).

De Nora (‘887) disclose an aluminum electrowinning cell with oxygen evolving anodes. See title. The cell for the electrowinning of aluminum has at least one non-carbon metal anode having an electrically conductive metallic structure which is suspended substantially parallel to a facing cathode. The metallic structure comprises a series of parallel horizontal anode members, each having an electrochemically active surface on which during electrolysis oxygen is anodically evolved. The anode members are spaced apart from one another by inter-member gaps forming flow through

openings for the circulation of electrolyte driven by the escape of anodically evolved oxygen. The electrolyte may circulate upwardly and/or downwardly in the flow through openings and around the anode structure. See abstract. The anode structure is a series of parallel horizontal anode members, each having an electrochemically active surface on which during electrolysis oxygen is anodically evolved, the electrochemically active surfaces being in a generally coplanar arrangement to form said active anode surface. The anode members are spaced apart to form longitudinal flow-through openings for the circulation of electrolyte driven by the fast escape of anodically evolved oxygen. See col. 2, lines 60-67. Depending on the cell configuration some or all of the flow through openings may serve for the flow of alumina rich electrolyte to an electrolysis zone between the anode and the cathode and/or for the flow of alumina depleted electrolyte away from the electrolysis zone. When the anode surface is horizontal or inclined these flows are ascending and descending. See col. 3, lines 1-7. The anode members may be spaced apart blades, bars, rods or wires. The bars, rods or wires may have a rectangular or circular cross-section or have in cross-section an upper semi-circular part and a flat bottom. The bars, rods or wires may be bell-shape or pear-shape in cross section. Each blade, bar or wire may be in rectilinear or concentric arrangement, each forming a loop to minimize edge effects of the current during use. Each blade, bar, rod or wire may be circular, oval or polygonal, rectangular or square, with rounded corners. See col. 3, lines 44-56. The temperature of conventional cells is 950 to 970 ^{0} C. See col. 6, lines 32-33. The cell may be operated with an operative temperature of the electrolyte below 910 ^{0} C, usually from 730 to 870 ^{0} C. The electrolyte may contain NaF and AlF_3 in

a molar ratio NaF/AlF_3 required for the operating temperature of the cell comprised between 1.2 and 2.4. See col. 7, lines 9-13. The inter-member gaps constitute flow through openings for the circulation of electrolyte and the escape of anodically evolve gas released at the electrochemically active surfaces. See col. 8, lines 3-6. The molten aluminum produced is space apart from the facing anodes by an inter-electrode gap. The baffles are provided upper downwardly converging surfaces and lower upwardly converging surfaces that deflect gaseous oxygen which is anodically produced below the electrochemically active of the anode members and which escapes between the inter member gaps through the foraminate anode structure. The oxygen released above the baffles promotes dissolution of alumina fed into the electrolyte above the downwardly converging surfaces. See col. 11, lines 23-31. An aluminum-wettable cathodic coating can be a slurry applied refractory hard metal coating such as that of a metal boride such as TiB_2. See col. 11, lines 43-50. Above and below the surface of the electrolyte, the sidewalls may be covered with a zinc oxide coating with alumina or zinc aluminate coating. See col. 12, lines 3-6. During cell operation, alumina is fed to the electrolyte over the baffles and the metallic anode structure. The fed alumina is dissolved and distributed from the bottom end of the converging surfaces into the inter electrode gap through the inter member gaps and around edges of the metallic anode structure between the neighboring pairs of anodes or between peripheral anodes and sidewalls. By passing an electric current between anodes and facing cathode cell bottom, oxygen is evolved on the electrochemically active anode surfaces and aluminum is produced which is incorporated into the cathodic molten aluminum. The

oxygen evolved from the active surfaces escapes through the inter member gaps and is deflected by the upwardly converging surfaces of baffles. The oxygen escapes from the uppermost ends of the upwardly converging surfaces enhancing dissolution of the alumina fed over the downwardly converging surfaces. See col. 12, lines 12-29. The electrolyte circulation is generated by the escape of gas released from the active surfaces of the anode members between the inter-member gaps and which is deflected by the upward converging surfaces of the baffles confining the gas and the electrolyte flow between their uppermost edges. See col. 12, lines 38-43. The anodically evolved gas escapes towards the surface of the electrolyte, where as the electrolyte circulation flows down through the downward converging surfaces, through the inter-member gaps and around edges of the metallic anode structure to compensate the depression created by the anodically released gas below the active surfaces of the anode members. The electrolyte circulation draws down into the inter-electrode gap dissolving alumina particles which are fed above the downward converging surfaces. See col. 12, lines 44-54. The uppermost end of the baffles are located below but close to the surface of the electrolyte to increase the turbulence at the electrolyte surface caused by the release of anodically evolved gas. See col. 12, lines 61-64. By guiding and confining anodically evolved oxygen towards the surface of the electrolyte with baffles or other confinement means oxygen is released so close to the surface as to create turbulences above the downwardly converging surfaces promoting dissolution of alumina fed there above. See col. 13, lines 1-8.

De Nora does not teach the a plurality of anode teeth, each of the anode teeth having a V-shaped bottom surface which slopes from a center line of a respective anode tooth toward an adjacent groove and are sloped in a longitudinal direction of the grooves and away from the at least one cathode.

De Nora ('304) disclose an electrolytic cell for the electrowinning of aluminum having a cathode cell bottom having cathode blocks connected side by side and having conductive bars for the delivery of current and a series of anodes facing the cathode cell bottom. The cathode blocks having a series of parallel channels or grooves . See abstract. The anode is above the cathode blocks and the cathode blocks have v-shaped grooves or channels, which blocks are covered by a shallow pool of molten aluminum or just the grooves or channels are partly filled with molten aluminum. See col. 6, lines 25-30. The shape of the cathode blocks is set forth with respect to depth and width and cross section. See col. 6, lines 31-41. The anodes face the cathodes. See col. 7, lines 3-14. The anodes are made of metal, metal alloy or cermet. See col. 9, lines 17-25. The U or V-shaped grooves are used to drain off the product aluminum to maintain canals of aluminum in the V or U-shaped grooves at a constant level. See col. 9, line 65 – col. 10, line 3.

DeNora ('340) discloses a cell for the production of aluminum having at lest on cathode and at least one anode which face one another and are both covered by the electrolyte. The upper part of the cell contains a removable thermic insulating cover placed just above the level of the electrolyte. The cathode is made of an electrically conductive material that serves to give uniform distribution of electric current to the

cathode from the current feeders which connect the cathode to the negative busbars. See abstract. The thermic insulating layer is disclosed to reduce heat losses from the anodically evolving gases and to enable the cell to operate without a frozen top crust of molten electrolyte and enables easy removal of the anodes for servicing. See col. 3, lines 36-42. The insulating cover also has passages for feeding alumina and for the exit of the evolved gases during electrolysis. See col. 3, lines 54-60. The anode is usually covered completely by the molten electrolyte with the current feeder remaining above the electrolyte. The anode is located above the cathode and facing each other. See col. 3, line 64 – col. 4, line 5. The anodes are made of metal alloys with an oxide surface. See col. 5, lines 14-22. The non-carbon oxygen evolving anodes facing the drained cathode with an aluminum wettable operative surface, enables the cell to operate with a narrow anode-cathode gap which enables a substantial reduction in the heat produced during electrolysis, leading to the need for insulation to prevent freezing of the electrolyte. See col. 7, lines 42-50. The cell bottom and sidewalls can also be insulated to reduce the cell heat loss. See col. 7, lines 51-54. An optional gas space to control the cell's heat balance, even if no heating or cooling gas is supplied but the possibility of supplying heating or cooling gas via the space provides an additional means for maintaining the cell and electrolyte at an optimum operating temperature without formation of a crust. See col. 7, line 63 – col. 8, line 2. The anodes each have a series of inclined active lower plates suspended by a vertical current lead in rod via current distribution members. See col. 8, lines 20-24. The anodes are suspended above the cathode with a series of active inclined anode surfaces on inclined plates facing the

corresponding inclined cathode surfaces leaving a narrow anode-cathode space. See col. 10, lines 37-41. The sloping inner active faces of the anode plates assist in removing the anodically-evolved gases. See col. 10, lines 47-49. Each anode provides an even distribution of electric current to the active anode plates. See col. 10, lines 56-58. The upper part of the anodes have openings through which the anodically generated gas can pass and which serve for the circulation of electrolyte induced by the released gas. See col. 11, lines 3-6.

Julsrud et al (‘079) disclose an improvement in anodes useful for retrofit of existing electrolysis cells wherein the anode is shaped in a manner to increase the area of the electroactive surface. See abstract. The improved anode is made of an inert material which is used to reduce the contamination of anode components in the aluminum metal produced and can be achieved by increasing the electroactive surface of the anode, thereby increasing the cathodic current density with respect to the anodic current density in the electrolysis cell. See paragraph 0006. The electrode design can be utilized to contribute to maintain acceptable metal purities in the retrofitted electrolysis cells. See paragraph 0007. By increasing the anode surface area, the anodic current density will decrease and as a result, the alumina concentration in the diffusion layer will increase. This will reduce the solubility of the inert anode species (as oxides) in the diffusion layer and also reduce the concentration of these species in the bulk electrolyte. As a result, the contamination of the produced aluminum metal by anode material components will be reduced and a commercial quality aluminum can be produced with inert anodes. This approach further increases the durability of the oxide

ceramic or metal or cermet inert anodes in the electrolysis cells. See paragraph 0009. The anode surface design in which the surface area is increased is done through forming or shaping of a series of pyramidal elements. See paragraph 0030. The anode surface area can be increased through the use of other shapes as well, such as those of protruding elements, having a plurality of recesses/steps that will actively contribute to the increase of the anode surface area. See paragraph 0032 and 0033. The effect on the anode surface area increase as a function of anode surface design changes. See paragraph 0034 and Table 1. The effect of surface design modifications on anode surface area are shown in Table 1, where the reference is a horizontal anode with a flat underside and the table expresses the percentage increase in anode surface area by introducing grooves, saw tooth, rows of peaks and valleys, etc. on the electroactive anode surface.

The subject matter as a whole would have been obvious to one having ordinary skill in the art at the time the instant invention was made because even though the prior art of DeNora ('887) does not disclose that the anodes have a V-shaped bottom surface which slopes from a center line of a respective anode tooth toward an adjacent groove and are sloped in a longitudinal direction of the grooves and away from the at least one cathode, the prior art of Julsrud et al shows that the use of grooves as well as other shapes are known to be used in making of the inert anodes to specifically increase the surface area of the anode to enable more uniform current density within the cell. Since the prior art of DeNora ('887) shows that the surface area of the anode is important, it would be within the ability of the person having ordinary skill in the art to replace the

anodes of DeNora (‘887) with an improved anode such as those set forth in the prior art of Julsrud et al which show the use of grooves and V-shapes and U-shaped anodes as well as other designs that improve the purity of the aluminum and further enable better removal of air bubbles and electrolyte flow in the anode-cathode interfaces. The prior art of DeNora (‘304) shows that the cathode can be shaped in a similar manner and the anode is flat, one having ordinary skill in the art would recognize that either of the anode or cathode could be shaped in this manner to achieve better electrolyte flow and air bubble dispersement from the anode-cathode interfaces, therefore, one having ordinary skill in the art would be motivated to design the anodes or cathodes to have the v-groove construction as set forth in the instant claims as presented. DeNora ('340) is disclosed to show that it is known in the art to use a thermic insulating cover to control the heat within the electrolysis cell and that gas spaces are known to be used to control the heat within the cell, as well as the anode-cathode gap and this would be considered to be a type of heat exchange process. Therefore, one having ordinary skill in the art would be motivated to use such thermic insulating cover, gas spaces and anode-cathode gap to better control the heat within the electrolysis cell in such heat exchange manner to enable better aluminum being produced. Table 1 of Julsrud et al appears to meet the requirements of the groove dimensions set forth in applicant's instant claims and therefore, would be within the ability of the person having ordinary skill in the art to use such anodes in the DeNora (‘887) cell to improve the active surface area of the anodes for better control of the aluminum production quality. Further, Julsrud et al appears to show that the anodes are cone-shaped or roof-shaped and have three or

more planes with surface angles, therefore this aspect of the instant invention is known. Therefore, it appears that the prior art of DeNora ('887) in combination with DeNora ('304) , DeNora ('340) and Julsrud et al ('079), render the applicants instant invention as obvious for the reasons set forth above.

Response to Arguments

8. Applicant's arguments with respect to claims 63-94 have been considered but are moot in view of the new ground(s) of rejection.

Applicants arguments appear to be with respect to the configuration of the inert anodes used in the aluminum production cell. The examiner has set forth a rejection in this office action showing that it is known in the art to improve the anode configurations using V-grooves, U-groove, pyramidal shapes, etc., to improve the anode surface area and to improve electrolyte movement within the cell as well as to release entrapped air bubbles which inhibit electrolyte movement. Therefore, it appears that applicants arguments with respect to this aspect of the invention have been found in the prior art and therefore, are obvious in view of the rejection made by the examiner above.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bruce F. Bell whose telephone number is 571-272-1296. The examiner can normally be reached on Monday-Friday 6:30 AM - 3:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

BFB
May 21, 2008

/Bruce F. Bell/
Primary Examiner, Art Unit 1795